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A BRIEF ACCOUNT OF THE LICK
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A BRIEF ACCOUNT
OF THE
LICK OBSERVATORY
OF THE
UNIVERSITY OF CALIFORNIA

PREPARED BY
EDWARD S. HOLDEN
Director of the Observatory

SECOND EDITION

SACRAMENTO
STATE PRINTING OFFICE
1895

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JAMES LICK
1796-1876

H72
1895

A BRIEF ACCOUNT
OF THE
LICK OBSERVATORY.

JAMES LICK, who gave to the world the Lick Observatory, was born in Fredericksburg, Pennsylvania, August 25, 1796, and died in San Francisco, October 1, 1876. His body lies in the base of the pier of the great Equatorial. He learned and practiced the trade of organ and piano-making in Hanover, Pennsylvania, and in Baltimore. In 1820 he was in business in Philadelphia. From there he went to Buenos Ayres, making and selling pianos. From the east coast of South America he came to the west, and finally, in 1847, he arrived in San Francisco.

Successful in business, but far more successful in his investments in land, he became rich, and died leaving an estate of some \$3,000,000. This was all devoted to public uses. His deed of trust charged the Board of Lick Trustees to expend:

For a monument in San Francisco to Francis Scott Key, author of the "Star Spangled Banner," the sum of \$60,000;

For statuary, emblematic of three significant epochs in the history of the State of California, to be placed in front of the San Francisco City Hall, \$100,000;

For a Home for Old Ladies in San Francisco, \$100,000;

For Free Baths in San Francisco, \$150,000;

For a California Institute of Mechanic Arts—a manual training-school for the boys and girls of San Francisco, \$540,000;

For the Lick Observatory, to contain the most powerful telescope in the world, \$700,000; besides many other important bequests, to the Society of California Pioneers, to the California Academy of Sciences and other beneficiaries.

His exact provisions in regard to the Observatory were:



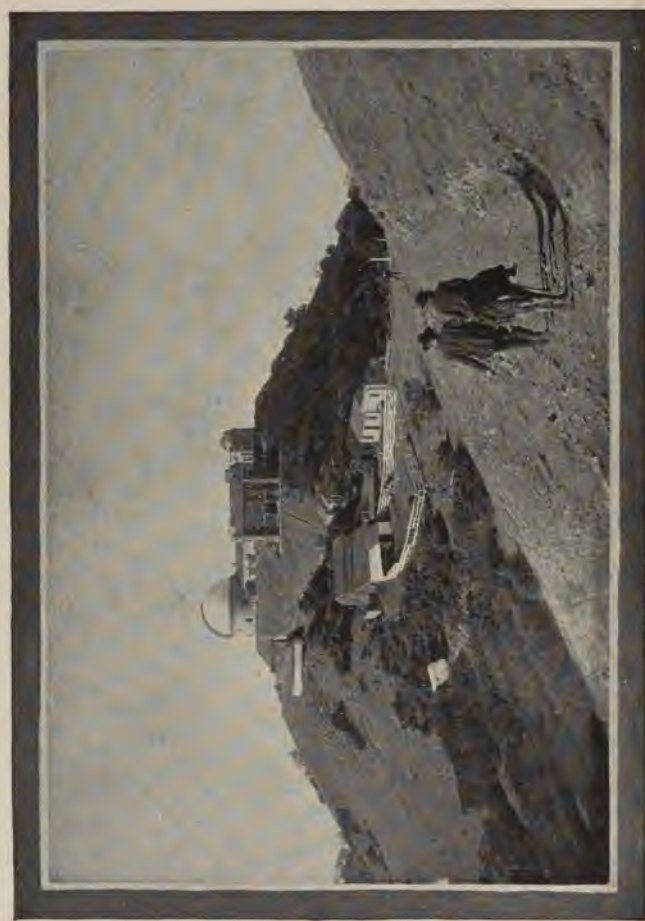
THE ROAD TO MT. HAMILTON.

MR. LICK'S SECOND DEED OF TRUST.

“Third—To expend the sum of seven hundred thousand dollars (\$700,000) for the purpose of purchasing land, and constructing and putting up on such land as shall be designated by the party of the first part, a powerful telescope, superior to and more powerful than any telescope yet made, with all the machinery appertaining thereto and appropriately connected therewith, or that is necessary and convenient to the most powerful telescope now in use, or suited to one more powerful than any yet constructed; and also a suitable observatory connected therewith. The parties of the second part hereto, and their successors, shall, as soon as said telescope and observatory are constructed, convey the land whereupon the same may be situated, and the telescope and the observatory and all the machinery and apparatus connected therewith to the corporation known as the Regents of the University of California; and if, after the construction of said telescope and observatory there shall remain of said seven hundred thousand dollars in gold coin any surplus, the said parties of the second part shall turn over such surplus to said corporation to be invested by it in bonds of the United States, or of the city and county of San Francisco, or other good and safe interest-bearing bonds, and the income thereof shall be devoted to the maintenance of said telescope and observatory, and shall be made useful in promoting science; and the said telescope and observatory are to be known as the Lick Astronomical Department of the University of California.”

BUILDING OF THE OBSERVATORY.

Under the provisions of this deed, a Board of Trustees, composed of Messrs. R. S. Floyd, William Sherman, E. B. Mastick, Charles M. Plum, and George Schoenwald, built the Observatory and transferred it to the Regents of the University on June 1, 1888. The whole cost of the establishment was \$610,000 (the instruments costing \$111,906.38), and \$90,000 is invested as an endowment.



THE OBSERVATORY FROM THE NORTH-EAST.

SUPPORT OF THE INSTITUTION.

The interest on \$90,000 is entirely insufficient for the support of the Observatory, and the deficiency is made up by annual appropriations from the University income. While these appropriations are as large as can be properly made, they are still far less than actual wants. The Lick Observatory is one of the best equipped institutions in the world, but its annual income is much less than that of any other establishment of the first class.

For the purposes of comparison, it may be stated that the number of persons employed in purely astronomical work at some of the leading observatories is: Observatory of Greenwich, about 30; Observatory of Harvard College, about 40; Observatory of Paris, about 17 astronomers and many computers; Observatory of Pulkowa (St. Petersburg), about 16; Observatory of Rio Janeiro, about 16; Observatory of Washington, D. C., about 19. The Lick Observatory has seven observers in all. The annual incomes of some of the establishments named above are three times those of the Lick Observatory, and the expenses of all of them are at least twice as much.

It is worth while to give this comparison explicitly, because the impression prevails that the Lick Observatory is as liberally endowed as it is magnificently equipped; whereas the facts are, unfortunately, very different.

GIFTS TO THE LICK OBSERVATORY.

The income of the Observatory is barely sufficient for its current work. For the purchase of special instruments and apparatus and for the expenses of expeditions sent to foreign countries for the purpose of observing total solar eclipses, we have had to depend on the gifts of numerous friends. Among them should be named: Miss C. B. Bruce of New York City; Hon. D. O. Mills of New York City; Hon. C. F. Crocker of San Francisco; Edison General Electric Company of New York City; Mrs. Phebe Hearst of San Francisco; W. W. Law of New York City; Dr. S. P. Langley, Smithsonian Institution, Washington;

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Dr. T. C. Mendenhall, U. S. Coast and Geodetic Survey, Washington; the trustees of the Thompson fund, A. A. A. S., and others.

OFFICERS OF THE OBSERVATORY.

The sections immediately following are extracted from the REGISTER of the University and give the official status of the Observatory as a part of the University:

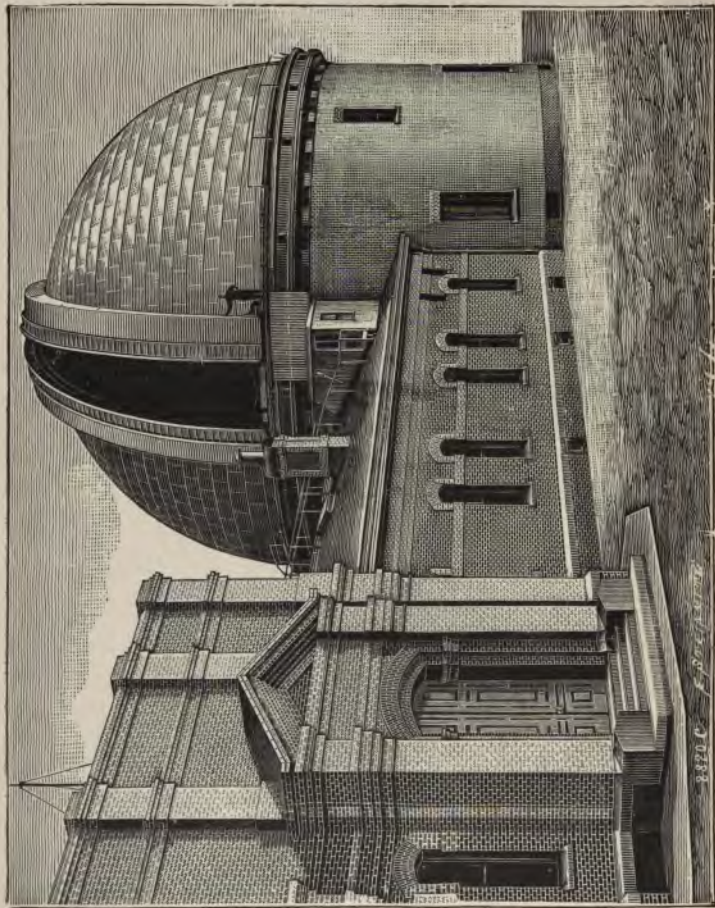
Martin Kellogg, President of the University; Edward S. Holden, Director and Astronomer; John M. Schaeberle, Astronomer; Edward E. Barnard, Astronomer; William W. Campbell, Astronomer; Richard H. Tucker, Jr., Astronomer; Allen L. Colton, Assistant Astronomer; C. D. Perrine, Secretary.

HISTORY OF THE LICK OBSERVATORY.

Mr. Lick, in August, 1875, selected Mount Hamilton, in Santa Clara County, as a site for the Observatory. Land for the site (1350 acres) was granted by Act of Congress, June 7, 1876. One hundred and forty-nine acres additional were purchased by Mr. Lick, and a tract of forty acres was added by gift of R. F. Morrow, Esq., in 1886. The north half of section sixteen of the township was granted to the University, for the use of the Observatory, by the Legislature of California in 1888. This land (320 acres) is continuous with the grant from the United States. Congress also granted in 1892 an additional tract of 680 acres, making the total area of the Reservation about 2581 acres. A road to the summit of Mount Hamilton (4209 feet above the sea), was built by Santa Clara County, at a cost of about \$78,000, in the year 1876.

BUILDINGS AND INSTRUMENTS.

The Observatory consists of a Main Building, containing computing rooms, library (of 3000 books and 3000 pamphlets), and the domes of the 36-inch equatorial and the 12-inch equatorial; and Detached Buildings to shelter the Meridian Circle, the Transit, the Horizontal Photo-Heliograph, the portable Equatorial, and the Crocker Photographic Telescope.



THE WEST FRONT OF THE OBSERVATORY

On the grounds are dwelling houses for the astronomers, students, and employés, and shops for the workmen. The Observatory is fully provided with instruments, the most important of which are named below.

36-inch equatorial; objective by Alvan Clark & Sons, mounting by Warner & Swasey. This instrument has also a photographic corrector of 33 inches, figured by Alvan G. Clark.

12-inch equatorial; by Alvan Clark & Sons.

6½-inch equatorial; objective by Alvan Clark & Sons, mounting by Warner & Swasey.

6½-inch meridian circle; objective by Alvan Clark & Sons, mounting by Repsold.

4-inch transit; objective by Alvan Clark & Sons, mounting by Fauth & Co.

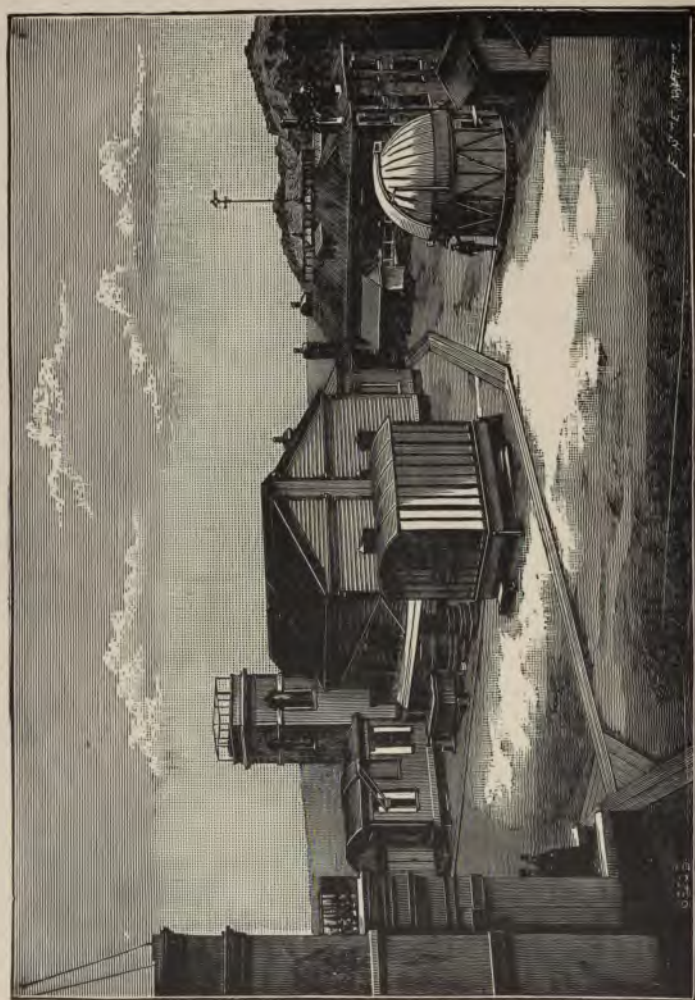
4-inch comet seeker; by Alvan Clark & Sons.

5-inch horizontal photo-heliograph; by Alvan Clark & Sons.

Crocker Photographic telescope; objective by Willard, refigured by J. A. Brashear, who provided the mounting also. There are, besides, many minor pieces of astronomical, physical, meteorological, and photographic apparatus, including spectroscopes, seismometers, photometers, micrometers, clocks, chronographs, etc.

REGULATIONS REGARDING STUDENTS.

The Regents of the University have established the following regulations: "The regular course of undergraduate work in astronomy in the University will be given in part in the Colleges of Science at Berkeley, and the remainder at the Lick Observatory. Students who are graduates of the University of California, or of a university or college of like standing, will also be received at the Lick Observatory to pursue a higher course of instruction in astronomy, provided that, after examination, they show themselves competent. Such students may become candidates for the higher degrees of the University, in the ordinary manner, or they may be received as special students merely. Quarters at Mount Hamilton may be assigned to them during that portion of the year occupied in their work with



LOOKING NORTH-EAST ON THE SUMMIT

the instruments, and in return for such quarters they will be required to execute such computations as are assigned to them."

"So many graduates as can be furnished accommodations at Mount Hamilton without expense to the University, may pursue astronomical studies with the Director at the Lick Observatory. Such graduate students must be either candidates for the higher degrees of the University, in the ordinary manner, or special students admitted with the consent of the President of the University, and the Director of the Observatory. Such candidates shall spend at least one year in their studies at Berkeley."

At present, all undergraduate instruction in astronomy is given at Berkeley, and the courses there are so arranged as to lead directly to graduate work at Mount Hamilton. Application for admission to graduate courses at the Observatory may be made at any time to the Recorder of the University at Berkeley; and students will be admitted on the recommendation of the Director, approved by the President of the University. Admission is ordinarily granted to graduates of the University of California, and also to graduates of other colleges and scientific schools of good standing who present satisfactory evidence of character and qualifications. Other persons of suitable age and attainments may also be admitted.

Students at the Lick Observatory may either be: (a) Candidates for one of the higher degrees of the University, or (b) special students. The higher degrees offered are Master of Arts, Master of Science, and Doctor of Philosophy. The conditions upon which they are granted are given in the REGISTER of the University, *except* that a residence at Mount Hamilton is required of all candidates for a Master's degree of *at least* four months, and of all candidates for a Doctor's degree of *at least* eight months. It is expected that students will choose their periods of residence at the Lick Observatory in the months June to November. In certain cases the requirement of Latin of candidates for the Doctor's degree *may* be remitted by the proper authority. In all cases a good reading knowledge of French and German will be required of such candidates. Particular attention is called to the fact that the higher degrees



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LOOKING SOUTH-WEST TOWARDS MT. HAMILTON

of the University are not given for mere faithfulness in the performance of allotted tasks, but that "power to do original work" (as exhibited in a thesis to be submitted before final examination, and in other ways) must be shown.

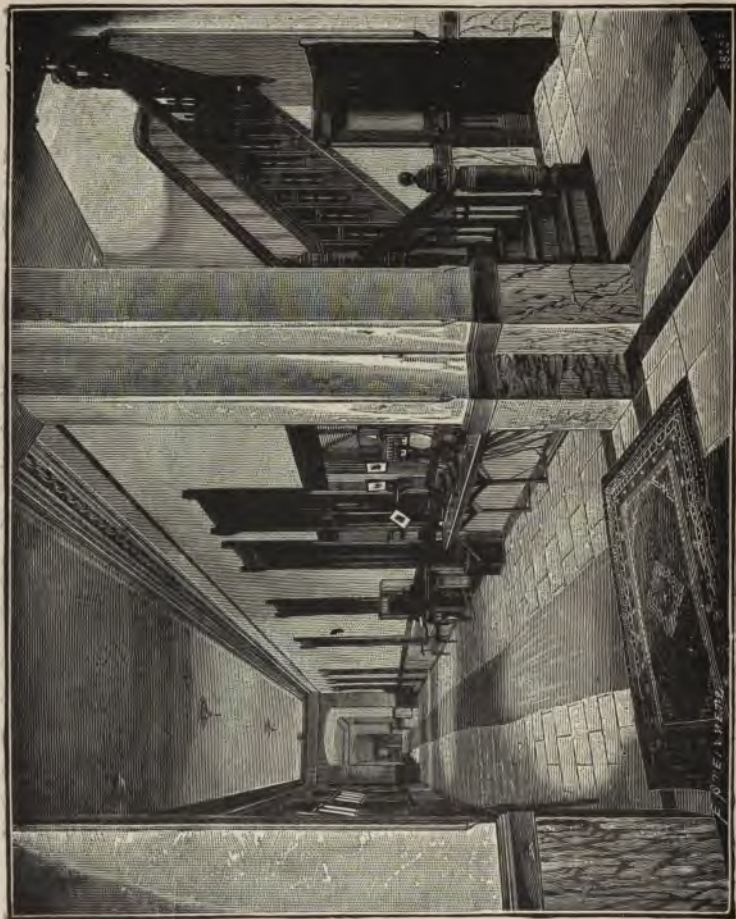
Special students are received (usually during the favorable observing weather, June to November), and every facility consistent with the scientific work of the establishment will be given to them. They will be required to follow out some line of work, to the satisfaction of the Director, and they will usually be assigned as assistants to some of the astronomers.

HEARST FELLOWSHIPS IN ASTRONOMY.

Mrs. Phebe Hearst has provided a fund to be used in aid of scientific work at the Lick Observatory. A portion of this fund may be set aside for the purpose of defraying a part of the expenses of such advanced students as may be appointed to be Hearst Fellows in Astronomy by the Board of Regents on the recommendation of the President of the University and of the Director of the Observatory. Such recommendations will not be made except of students who have already made decided progress in their work; and candidates for the higher degrees of the University will be preferred, in general.

QUARTERS FOR STUDENTS.

Comfortable quarters (unfurnished) are allotted to all students at the Observatory. A kitchen and dining-room (partly furnished) are also provided for the common use of students, who must make their own arrangements for board and service. The cost per month to each student need not exceed \$30. No charges or fees of any sort for instruction are required from students in the University. All injuries to instruments or apparatus must be made good at the student's expense, and students are expected to provide the larger part of the chemicals used in their practice of photography. Each student should bring with him the furniture of his bed, etc., and should also provide himself with text-books.



THE LONG HALL

Intending students will do well to communicate with the Director of the Observatory before making their formal applications for admission to the Recorder. The postoffice address is Mount Hamilton, Santa Clara County, California.

HOURS FOR VISITORS.

The Board of Regents of the University of California has established the following regulations:

Visitors will be received at the Lick Observatory during office hours, whenever any of the astronomers are present.

Regular nights in each month, not exceeding one per week, shall be set apart for the reception of visitors, except during inclement weather, and visitors will be received on these nights between certain hours and at no other times.

The Observatory buildings will be open to visitors during office hours, every day in the year. Upon their arrival, visitors will please go at once to the visitors' room and register their names.

An hour or so can be profitably occupied in viewing the different instruments, and the rest of the stay can be well spent in walks to the various reservoirs, from which magnificent views of the surrounding country can be had. At least an hour and a half of daylight should be allowed for the drive from the Summit to Smith Creek. **There are no hotel accommodations at the Summit.**

For the present, visitors will be received at the Observatory to look through the great telescope every Saturday night, between the hours of 7 and 10, and **at these times only.**

Whenever the work of the Observatory will allow, other telescopes will also be put at the disposition of visitors on Saturdays between the same hours (only).

At 10 P.M. the Observatory will be closed to visitors, who should provide their own conveyance to Smith Creek, as there is no way of lodging them on the mountain.

It is expected by setting apart these times for visitors (which



THE GREAT EQUATORIAL

allow freer access to the Lick Observatory than is allowed to any other observatory in the world) that all interested may be able to arrange their visits in conformity to them; and that the remaining hours of the week will be kept entirely uninterrupted in order that the astronomers may do the work upon which the reputation and the good name of the Observatory entirely depends.

NUMBER OF VISITORS.

Visitors admitted for the year ending June 1, 1889.....	6,400
Visitors admitted for the year ending June 1, 1890.....	5,132
Visitors admitted for the year ending June 1, 1891.....	5,005
Visitors admitted for the year ending June 1, 1892.....	5,959
Visitors admitted for the year ending June 1, 1893.....	5,472
Visitors admitted for the year ending June 1, 1894.....	5,747

Visitors admitted since June 1, 1888..... 33,715

Those visitors who come in the day time are personally conducted through the various buildings at 1:30 P.M. and the uses of the instruments are explained to them. On Saturday nights the number of visitors ranges from 30 to 300. Each person is shown the most interesting celestial objects through the 36-inch and the 12-inch equatorials. The whole force of the Observatory is on duty at such times and no pains are spared to make these visits profitable and interesting. The senior classes in astronomy in the University of California and in various other Californian colleges come to the Observatory on evenings specially set apart for them. Lectures are given by the astronomers at different places and times. All specially interesting observations and discoveries are described in the magazines or the daily press. The Astronomical Society of the Pacific, which numbers more than five hundred members, holds its summer meetings at Mount Hamilton.

In these and other ways the Observatory is made directly useful to the public of California, and it cannot fail to have an important part in the intellectual advancement of the whole country.



INSTRUMENTS OF THE OBSERVATORY.

The instrumental equipment of the Observatory is of the highest excellence, and it is practically complete with one exception. From the beginning it was contemplated to supplement the great refracting telescope by a large reflector. This part of the original plan has not yet been carried out, but our experience has demonstrated the need of such an instrument, and it is very important that this addition should be made. When it is made, two great telescopes—a refractor and a reflector—will still give to the Observatory the most powerful instrumental equipment in the world.

From 1888 to 1893 the 36-inch refractor of the Lick Observatory was the largest in the world. In the present year a 40-inch telescope has been completed for the University of Chicago.

SCIENTIFIC WORK OF THE ASTRONOMERS.

It is quite impossible in the present place, to speak of the scientific work of the Observatory in any detailed way.

Ten new comets, a great number of double stars, and a new satellite to Jupiter have been discovered here. The photographs of solar eclipses and the results drawn from them by our astronomers have put a new face on the question of the constitution of the solar corona. The detailed study of the sun's surface, by photography, has lately been taken up.

Photographic and visual observations of Comets, the Milky Way, the Moon and Planets have added very greatly to our knowledge. Our spectroscopic observations of Nebulae, Stars and Comets are of hitherto unattained accuracy and have led to quite new views. For the first time the angular diameter of a fixed star has been measured here. For details regarding these discoveries and observations reference must be made to the publications of the astronomers in the scientific journals, and especially to the "Notices from the Lick Observatory" printed by the Astronomical Society of the Pacific.

Owing to the comparatively small income of the Observatory it has not been possible to undertake researches in all branches



THE TWELVE-INCH EQUATORIAL

of astronomy. The attempt has been to select a certain number of fields and to attain excellence in each field selected. Whenever an increased endowment, by gift or otherwise, becomes available, new fields can be occupied, with every prospect of success. The site of the Observatory is very favorable in all respects. Its instrumental equipment is unrivalled.

COÖPERATING FOREIGN ASTRONOMERS.

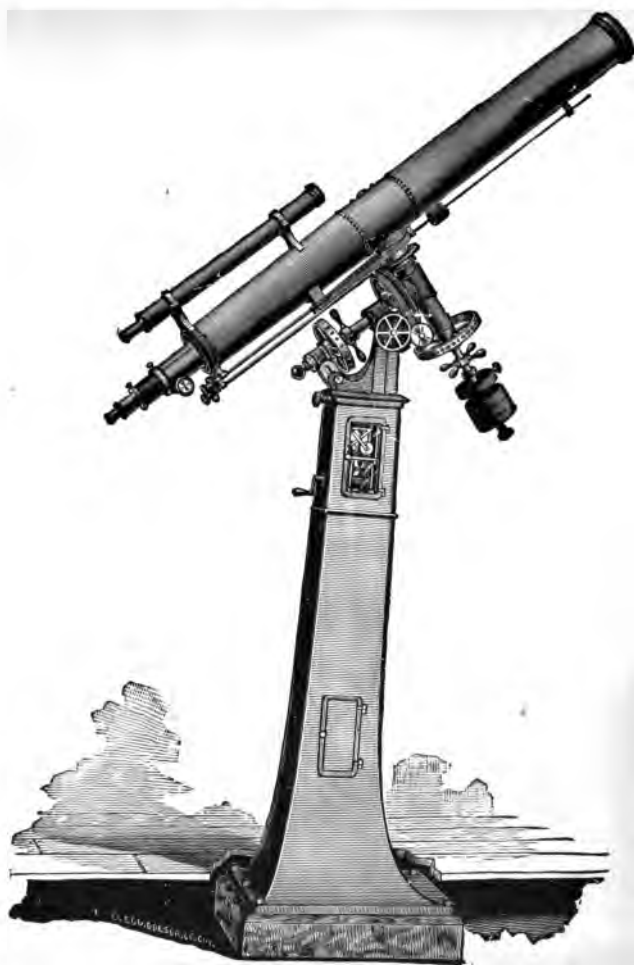
The Lick Observatory is in close coöperation with all other astronomical observatories and with astronomers abroad and at home. Several foreign astronomers are giving a large part of their working time to measures and discussions of astronomical photographs made here. Among these gentlemen especial mention should be made of Professor Weinek, Director of the Observatory of Prague, who is engaged in making enlarged drawings and photographs from the negatives of the moon taken here; Baron Albert von Rothschild of Vienna is working in the same direction; Professor Franz of the University of Königsberg; Dr. Victor Nielsen of Copenhagen; Dr. Boeddicker, astronomer in Lord Rosse's Observatory; A. Stanley Williams, F.R.A.S., of London, and others. All of these astronomers are assisting the Observatory in different researches by systematic work of the same kind which they would do if we were so fortunate as to number them among our immediate colleagues.

TIME SERVICE.

Accurate time signals are sent from the Observatory every day at noon, and are received at every railway station between San Francisco and Ogden; San Francisco and El Paso; San Francisco and Portland, Oregon. In this way the Observatory furnishes exact time (Pacific Standard time), without cost, to the inhabitants of many States and Territories.

EARTHQUAKE OBSERVATIONS.

A complete set of earthquake instruments registers the time and intensity of all shocks felt here, and a catalogue of such statistics is yearly printed. These are the first systematic observations of the kind made in California. Meteorological records are also kept.

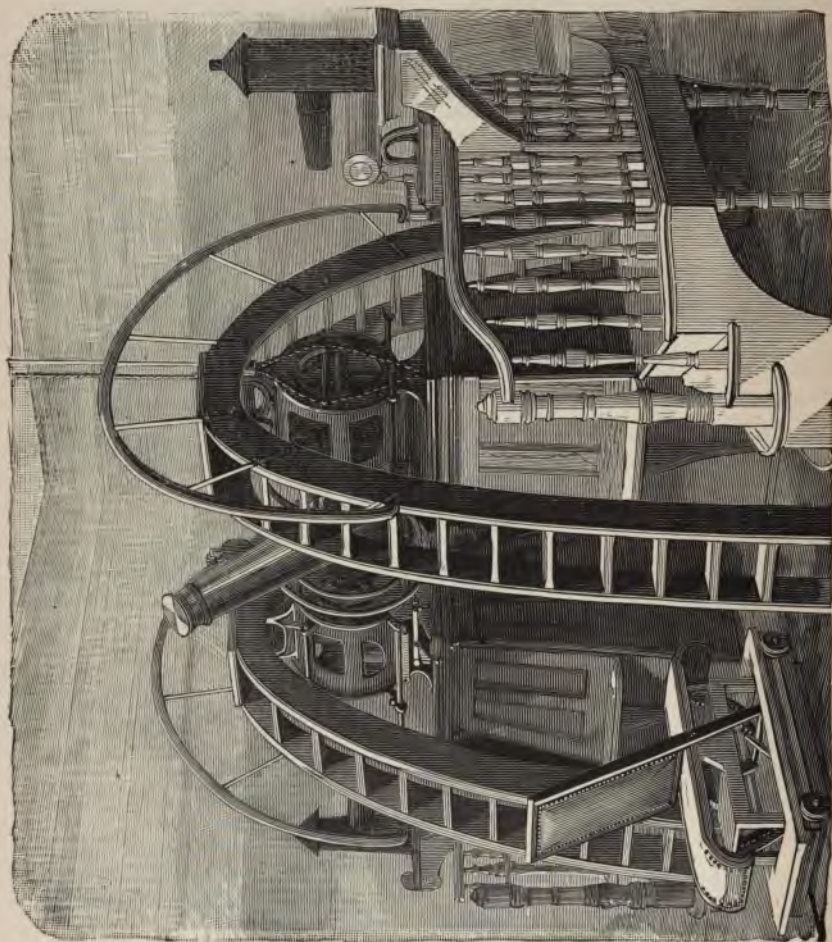


THE SIX-INCH EQUATORIAL

WORKS ISSUED BY THE LICK OBSERVATORY.

Two series of works, the first, in quarto, known as "Publications of the Lick Observatory;" the second, in octavo, known as "Contributions from the Lick Observatory," are printed from time to time by the direction of the Regents of the University. They are technical in character. They are not for sale, but are exchanged with other scientific institutions in return for gifts to the library of the Observatory. The works already published are:

1. Publications of the Lick Observatory of the University of California, prepared under the direction of the Lick Trustees, by Edward S. Holden, Volume I, 1887. Sacramento, 1887, 4to. [Containing a brief history of the Observatory, with descriptions of the buildings and instruments; observations of double stars by S. W. Burnham, 1879; of the transit of Mercury, 1881, by Messrs. Floyd, Holden and Burnham; of the transit of Venus, 1882, by D. P. Todd; meteorological observations, by T. Fraser, 1880-85; and reduction tables for Mount Hamilton, by G. C. Comstock.]
2. Suggestions for Observing the Total Eclipse of the Sun on January 1, 1889, by Edward S. Holden. Printed by authority of the Regents of the University of California. Sacramento, 1888, 8vo. [Out of print.]
3. Contributions from the Lick Observatory, No. 1. Reports on the Observations of the Total Eclipse of the Sun of January 1, 1889, published by the Lick Observatory. Printed by authority of the Regents of the University of California. Sacramento, 1889, 8vo. [Out of print.]
4. Contributions from the Lick Observatory, No. 2. Reports on the observations of the total eclipse of the sun, December 21-22, 1889, and of the total eclipse of the moon, July 22, 1888, to which is added a catalogue of the library, published by the Lick Observatory. Printed by authority of the Regents of the University of California. Sacramento, 1891, 8vo. [Out of print.]
5. Contributions from the Lick Observatory, No. 3. Terrestrial atmospheric absorption of the photographic rays of light,



THE MERIDIAN CIRCLE

by J. M. Schaeberle, astronomer in the Lick Observatory. Printed by authority of the Regents of the University of California. Sacramento, 1893, 8vo.

6. Publications of the Lick Observatory of the University of California. Printed by authority of the Regents of the University. Volume II, 1893. Sacramento, 1893, 4to. [Containing double star observations made with the 36-inch and 12-inch refractors of the Lick Observatory from August, 1888, to June, 1892, by S. W. Burnham.]

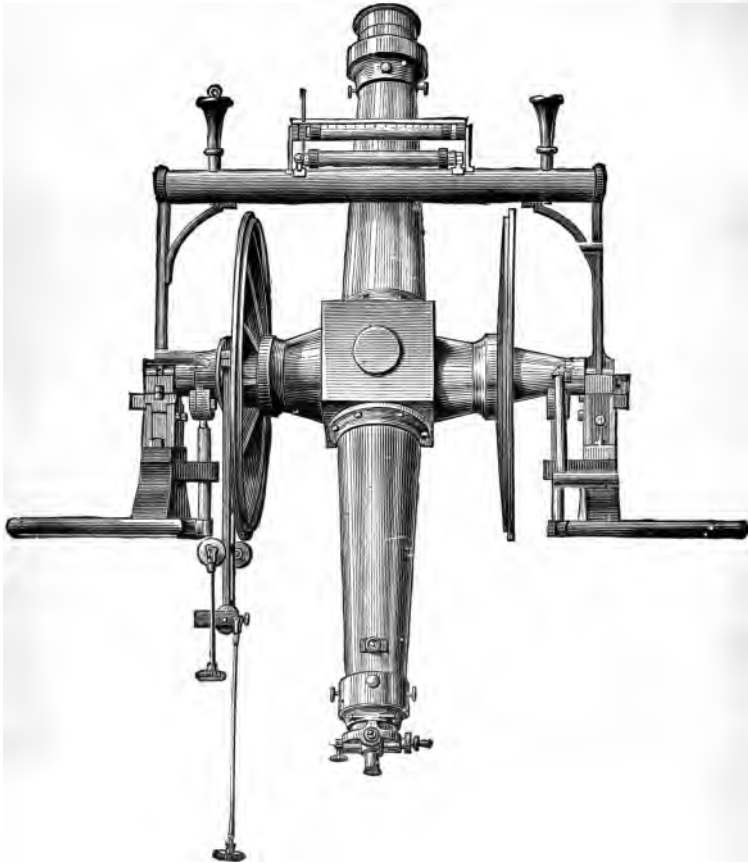
Other volumes are now in preparation.

The publications of the Astronomical Society of the Pacific contain notices from the Lick Observatory, which are brief accounts of the scientific work of the institution, prepared by the astronomers. Especial pains are taken to put these accounts into a simple and popular form. The history of the Observatory can be followed from month to month in these publications.

EXHIBITS AT THE MIDWINTER FAIR.

With the aid of an appropriation from the Santa Clara County Board of World's Fair Commissioners an exhibit of transparencies and photographic prints was prepared for exhibition at Chicago in the Santa Clara County space of the California building. At the Midwinter Fair this exhibit was displayed in the Santa Clara County building.

The Regents of the University directed that the Observatory prepare a second exhibit to be displayed at the Midwinter Fair in the space allotted to the University of California, since the Observatory is one of the departments of the State University. This second exhibit is somewhat fuller than the exhibit at Chicago, as many new negatives have been obtained since June, 1892, when the first exhibit was completed. The chief features of both these exhibits are framed glass transparencies of astronomical and other negatives made by the astronomers of the Observatory, and also enlargements from these negatives made either at Mount Hamilton, or by foreign astronomers and experts.



THE TRANSIT INSTRUMENT

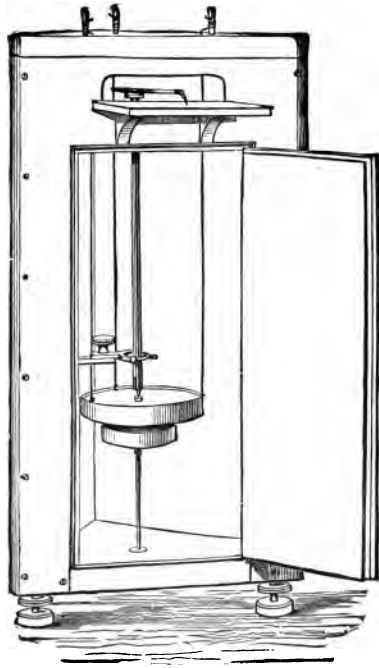
Each picture bears a label which gives the necessary information regarding it. Copies of many of these negatives can be purchased from the leading photographers of San Francisco and San José. Attention is particularly directed to photographs of the solar coronas of 1889, January; 1889, December; and 1893, April, by Messrs. Burnham, Schaeberle and Barnard; to photographs of the moon, in the focus of the large telescope, taken by various astronomers; to the very-successful enlargements of these negatives, made by Baron Rothschild of Vienna, Professor Weinek, Director of the Observatory of Prague, Victor Nielsen of Copenhagen, and by Mr. Colton of the Lick Observatory. These enlargements are of various scales, from the moon's diameter equal to ten feet downward; to photographs of the milky way and comets, by Professor Barnard; to star maps in both the Northern and Southern hemispheres; to photographs of nebulae, and especially to pictures of the total solar eclipse of April, 1893, by Professor Schaeberle; to photographs of drawings of Mars and of comets, by Professor Hussey; to spectrum photographs and drawings by Professor Campbell; to photographs (enlarged) of Jupiter, taken with the large telescope; to photographs of the sun and sun spots, taken by Mr. Perrine, and to views of the Lick Observatory, its instruments and its surroundings, taken by all the astronomers.

In conclusion, it should be stated that the present pamphlet has been prepared by direction of the Regents of the University.

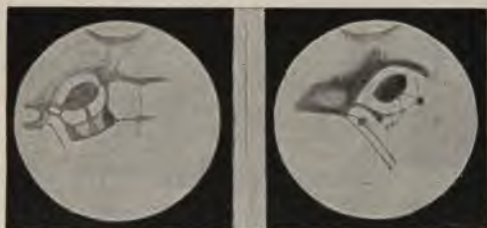
EDWARD S. HOLDEN.

LICK OBSERVATORY,

November, 1894.



THE EARTHQUAKE RECORDER



1892, Aug., 14d., 11h., 15m., P.S.T. 1892, Aug., 17d., 11h., 15m., P.S.T.

SKETCHES OF MARS, SHOWING CANALS.



LUNAR LANDSCAPE.

Drawn by Professor L. Weinek from the Negative taken at the Lick Observatory on August 23, 1888.

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